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**Calibration of Micromachined Force Sensors by Gravitational Force on Precision Microspheres** STEVEN J. KOCH, University of New Mexico, GAYLE E. THAYER, ALEX D. CORWIN, MAARTEN P. DE BOER, Sandia National Laboratories — To complement the existing tools for applying and measuring piconewton-level forces on biomolecules (e.g. optical tweezers, magnetic tweezers, AFM), we are developing a compliant micromachined spring for simple and direct measurements in an aqueous environment. Accurate calibration of the spring constant is crucial and we will present a gravitational method that uses NIST-traceable size standard microspheres. The method is applicable to calibration of other soft cantilevers of both in-plane and out-of-plane varieties. We affixed two microspheres to the force sensor and measured a deflection per bead of  $196 \text{ nm} \pm 6\%$ . Using a weight of  $150 \text{ pN} \pm 4.8\%$  per microsphere, we obtained a spring constant of  $0.76 \text{ pN} / \text{nm} \pm 8\%$ . The method proved simpler and more reliable when compared to two other methods: high resolution SEM and thermal equipartition. The versatility of surface micromachining should enable use of the spring in new platforms for biophysical force measurement, for example on-chip load cells for dynamic DNA stretching.

Steven J. Koch  
University of New Mexico

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